FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES

FIT PROJECT

TASK REPORT TO THE ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. 68-01-6056

INTERIM REPORT
on
THE GEOLOGY AND GROUNDWATER
of
North And East Woburn, Massachusetts

April 3, 1981

TDD No. F1-8010-02A
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Region 1 Field Investigation team

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on
The Geology and Groundwater
North and East Woburn, Massachusetts

The following Region 1 Field Investigation Team members made major contributions to this study in the capacities noted:

Project Manager	-	David K. Cook
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SECTION 1 - INTRODUCTION

1.1 PURPOSE OF STUDY

To gather groundwater and sub-surface geologic data necessary to develop appropriate remedial actions for East and North Woburn, Massachusetts under the auspices of the Environmental Protection Agency using funds provided for by the Hazardous Waste Containment Act of 1980.

1.2 OBJECTIVES

1.2.1 To prepare bedrock surface contour, groundwater elevation contour, water table contour, groundwater flow, and base maps for the study area delineated in Figure 1.

1.2.2 To develop appropriate geologic cross-sections for the study area.

1.2.3 To site additional monitoring wells necessary to locate the sources of and delineate contamination plumes within the study area.

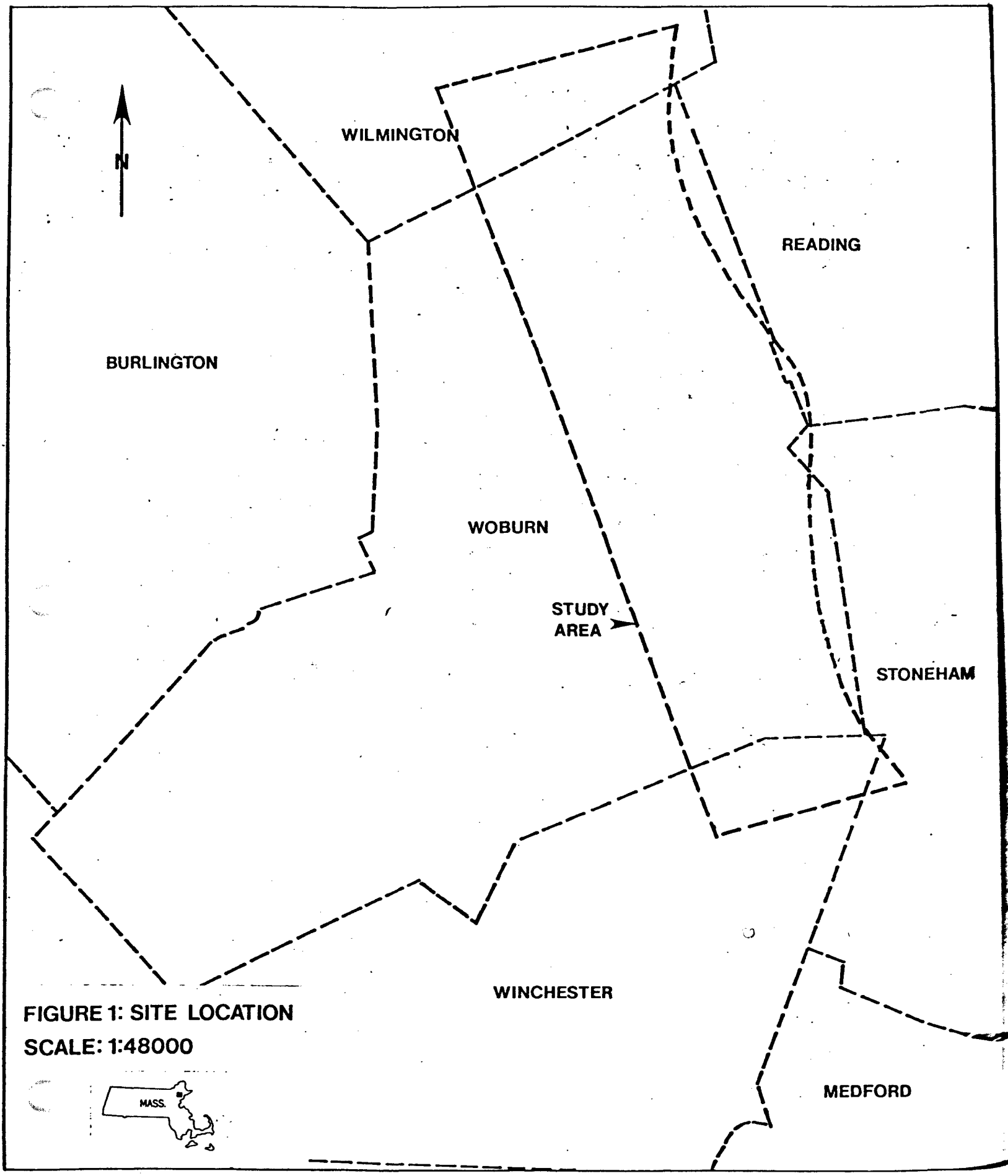


FIGURE 1: SITE LOCATION
SCALE: 1:48000

SECTION 2 - BACKGROUND

This report is in response to TDD's F1-8010-02A and 03A tasking the Ecology and Environment, Inc. (E & E) Region 1, Field Investigation Team (FIT) to gather groundwater and subsurface geologic data for the Woburn study area. A number of sites within the study area have been investigated by the FIT during the past year (Ref. 1 to 3). These investigations indicated that significant levels of potentially hazardous materials (primarily non-chlorinated volatile organics) are entering the Metropolitan District Commission (MDC) and City of Woburn sewer systems. However, at the time of the inspections, no leachable deposits of hazardous materials were present at any of the sites.

It is well-established that the northern portion of the study area has been used for many years as a disposal site for wastes including heavy metals and solvents. FIT investigations have identified several other sites within the study area which may have been used in the past for the disposal of wastes possibly including hazardous materials. Figure 2 is a map of the sites which have been or will be investigated during the course of groundwater studies of the area.

Analyses of well water from various parts of the study area indicate widespread groundwater contamination. This contamination will be addressed in a later report to be prepared under TDD # F1-8010-04B.

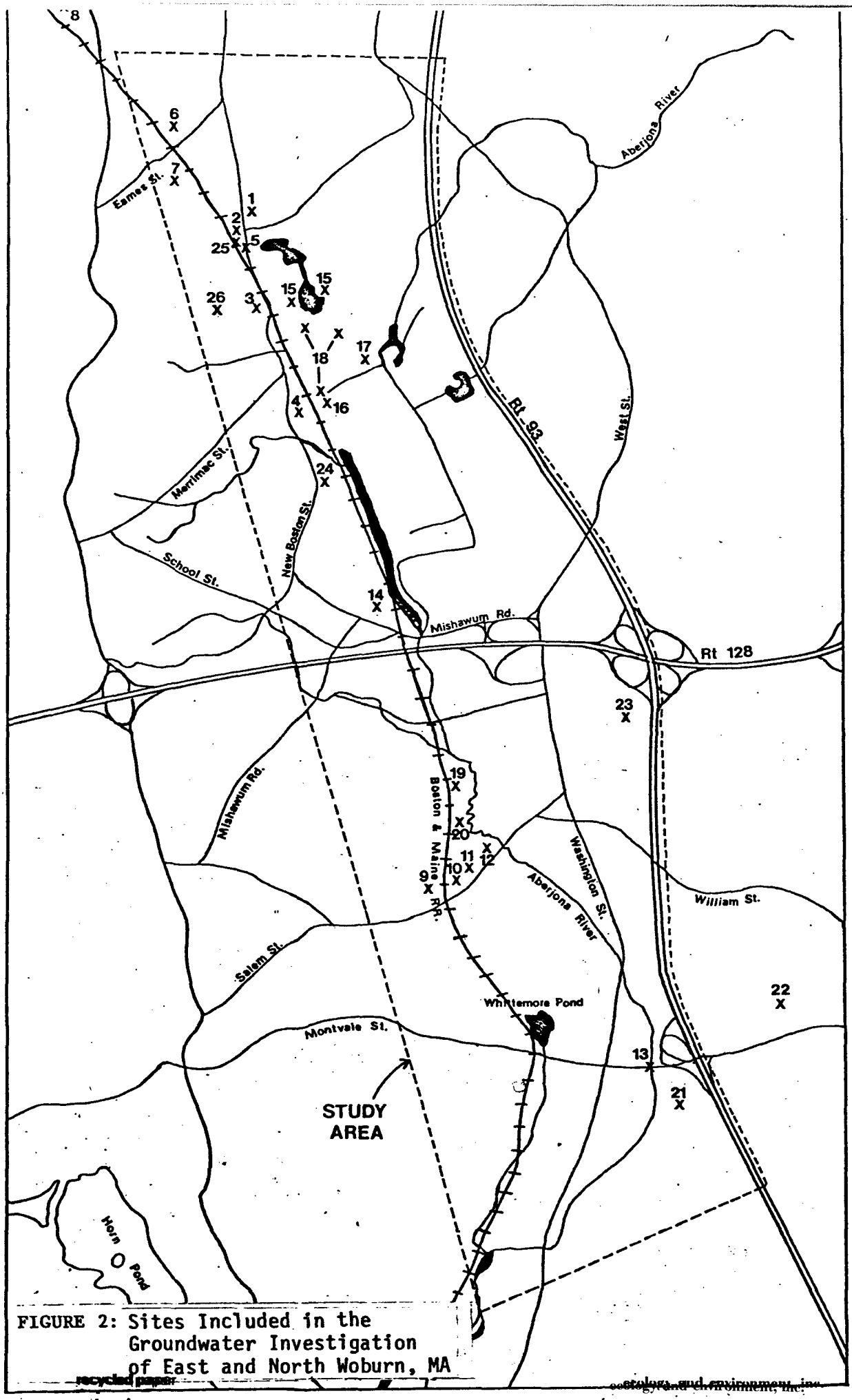


FIGURE 2: Sites Included in the Groundwater Investigation of East and North Woburn, MA

KEY FOR FIGURE 2

Sites Included in the Groundwater Investigation of East and North Woburn, Massachusetts

1. Ritter Trucking Company, Inc.*
2. E. C. Whitney & Sons*
3. New England Pigments and Resins*
4. Woburn Steel Drum*
5. MDC Septage Receiving Station*
6. Raffi and Swanson, Inc.*
7. Olin Chemical Group, Wilmington Plant*
8. Polyvinyl Chemicals Industries
9. John J. Riley Company*
10. Murphy's Waste Oil Service
11. Whitney Barrel Company - Salem Street*
12. Aberjona Auto Parts, Inc.*
13. Tanners Degreasing
14. Former City of Woburn Sanitary Landfill
15. Present Location of Hide Piles
16. Chromium Lagoon
17. Former Location of Hide Piles
18. Arsenic Pits
19. Arsenic Trioxide Drums (now removed)*
20. Unlabelled Barrels and Drums along unpaved road; possible area of midnight dumping.*
21. Atlantic Gelatin*
22. Stoneham - Sweetwater Brook upstream of Atlantic Gelatin
23. Independent Tallow Company*
24. Formerly Roketenetz Pig Farm
25. Whitney Barrel Company - Storage Area*
26. Present location of Woburn Sanitary Landfill*

* Sites Investigated to date.

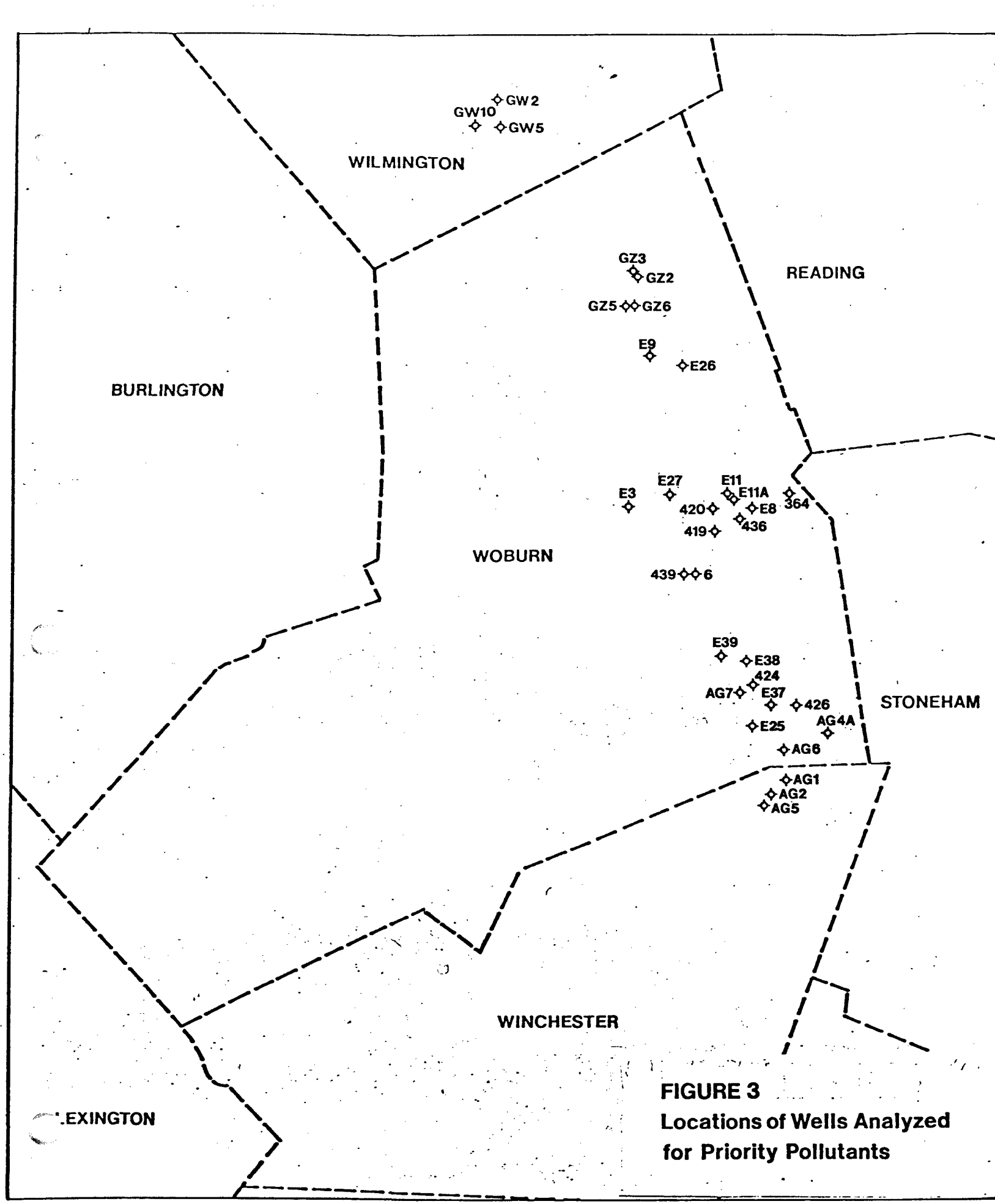


FIGURE 3
Locations of Wells Analyzed for Priority Pollutants

SECTION 3 - METHOD OF INVESTIGATION

The most practical approach for determining the origin(s) and extent of groundwater contamination within the Woburn study area (10 square miles) is to determine subsurface geology and the directions of groundwater flow for the area. From this information and existing analytical data, monitoring wells can be properly and cost effectively located to delineate the vertical and lateral extent of contamination and possibly locate the sources. It is likely that some detected groundwater contaminants were introduced at an undetermined time in the past from a no longer existing source. In this case, it may not be possible to locate the source.

The approach used to determine bedrock geology and groundwater flow directions and to site monitoring wells was as follows:

a) All available data from the literature regarding the geology and groundwater of the study area were reviewed.

b) All available analytical data were reviewed.

c) A base map was constructed using 1980 color aerial photographs.

d) A topographic contour map was prepared from the following U.S.G.S. topographic sheets for the area: Lexington (1971), Boston North (1979), Reading (1979), Wilmington (1979).

e) Well logs for 123 wells (See Appendix A) were constructed from existing data.

f) The seismic survey was performed by Dames and Moore.

g) Static water levels were measured at all accessible wells.

h) A field reconnaissance of all rock outcrops was performed.

i) A water table elevation contour map was constructed using a), f) and g).

j) Groundwater flow directions were determined from i).

k) A bedrock surface contour map was constructed using a), c), d), e), f) and h).

3. Method of Investigation - continued

l) Twelve geologic cross-sections were constructed using d), e), and k).

m) Appropriate sites for additional monitoring wells were chosen using i) and k).

n) Specifications for the additional monitoring wells were calculated using d), i) and k).

The primary sources of information used during this investigation were:

a) Static water level measurements taken by E & E at existing wells.

b) Existing drillers logs and groundwater data for accessible and non-accessible wells and bore holes. (References 11 to 22).

c) Priority pollutant analyses of well water (References 4 to 10).

d) Seismic survey of the study area performed by Dames & Moore under subcontract to E & E (Reference 23).

e) Field investigation of bedrock outcrops by E & E personnel.

f) U.S.G.S. topographic maps (Reference 24).

g) Conventional black and white and color aerial photographs of the study area. (References 25 to 29).

h) Bedrock geology studies of the area (References 30 to 37).

The seismic investigation of the study area provided the bulk of the information used to construct the bedrock surface contour map. Following is a description of the methods used to gather and interpret the seismic data.

3. Method of Investigation - continued

The refraction profiles were surveyed using vertically oriented geophones which were placed on the ground surface to detect energy released by a surface impact. The geophones were normally spaced at 25-foot intervals along the line of the profile. In some cases, where bedrock was expected to be shallow, an alternative spacing of ten feet was used. A sand-filled bag was placed over each of the geophones to insure an adequate coupling to the ground surface. The energy detected by the geophones was generated by the repeated dropping of a 140-pound SPT sampling hammer on a flat plate. The hammer was raised and dropped with the aid of a modified Acker drill winch. The resulting signal was recorded on a 12-channel Nimbus seismic recorder. The Nimbus recorder mathematically sums the signal of the individual impacts for each impact location. The result is an enhanced coherent signal and the cancellation of incoherent noise.

A basic geophone and cable layout (spread) 275 feet in length was used to conduct the survey. A series of impacts were made at four locations along each spread; at both ends and 200 feet off end and in line with each end. Where property access was limited or shallow bedrock was indicated, the off-end shots were located closer, generally 100 feet off end.

The records obtained during the field program were evaluated by picking the time after shot detonation of the onset of motions, or the first arrival, at each geophone location. Each arrival time was plotted against the distance of the geophone from shot to produce a time distance plot.

Apparent compressional wave velocity determinations were made by applying best-fit line segments through the time distance data. The inverse slope of each line segment represents the apparent velocity of an acoustic layer. Principles which govern the refraction of a wave travelling through a layered medium were used to solve for the thickness of each layer indicated on the line distance plots. Depth determinations were made by the intercept solution method. The calculated depths to bedrock and water table were corrected to the Mean Sea Level (MSL) datum using surface elevations provided by Ellis Land Surveying Inc. of Reading, Massachusetts.

SECTION 4 - RESULTS OF INVESTIGATION

4.1 BASE MAP, SCALE 1:9600 (Sheet #1).

The base map was drawn as a direct overlay on 1980 color aerial photographs supplied by the EPA.

The following are included in the base map:

a) All railroads and major roads

b) Town boundaries

c) Surface drainage mapped using stereo aerial imagery

d) Locations of all accessible and inaccessible wells for which logs and/or priority pollutant analyses are available.

e) Recommended locations for additional monitoring wells. See Section 5. for the rationale for these locations.

f) Recommended surface water sampling locations (See Reference 38)

4.2 GROUND ELEVATION CONTOUR MAP, SCALE 1:9600 (Sheet #2).

The ground elevation contours were transferred to this map from the 1:25000 U.S.G.S. topographic maps of the area (Reference 24). The study area is dominated by the Aberjona River Valley which trends north-south and decreases in elevation from approximately 65 feet mean sea level (MSL) in the north to 30 feet MSL in the south. Surface elevations rise rapidly to greater than 150 feet MSL on either side of the river valley giving the area a trough-shaped surface expression. This map was used in conjunction with the bedrock surface contour map to calculate the depths of proposed monitoring wells and for the construction of the geologic cross-sections. A 50-foot contour interval was used to indicate the broad topographic configurations of the study area and avoid obscuring the base map. The U.S.G.S. topographic sheets offer a smaller contour interval (10 foot) which may be useful for specific site locations.

4. Results of Investigation - continued

4.3 WATER TABLE CONTOUR MAP, Scale 1:9600 (Sheet #3)

Static water level measurements taken from the literature and in the field supplemented by data gathered during the Dames and Moore seismic investigation were used to construct the water table contour map. A contour interval of ten feet was used.

The following assumptions were made during the construction of the water table contour map:

A. Homogeniety of unconsolidated materials between data points

B. Identity of the datum elevations used for surveying surface elevations

C. As virtually no screen setting data were available for the inventoried wells, no head pressure differential calculations could be made. It is assumed that no confined aquifers are present in the study area, and existing data are consistent with this assumption

Groundwater flow closely parallels surface water flow throughout the study area. Groundwater from the west, north and east moves toward the center of the area and then south into Winchester. Contours in the Sweetwater Brook area are close together indicating a strong gradient from Stoneham into South Woburn. The groundwater depression near the center of the area represents the drawdown resulting from the pumping of J. J. Riley Company's well (#6). The groundwater depression in the southern portion of the area represents the drawdown resulting from the pumping of Atlantic Gelatin's production wells (#139, #26 and #27).

This map was used in conjunction with existing analytical data to locate proposed monitoring well locations. This map was also used in conjunction with the bedrock surface contour map to calculate the saturated thickness of sediments overlying bedrock associated with each proposed monitoring well location. Specifications for the proposed monitoring well drilling request for bids (RFB) were based on screening the entire saturated thickness of sediments.

4. Results of Investigation - continued

4.4 BEDROCK SURFACE CONTOUR MAP, SCALE 1:9600 (Sheet #4)

The bedrock surface contour map was prepared using the results of the seismic investigation described in Section 3, field reconaissance, and well data from the literature. A twenty-foot contour interval was used. Of the 123 wells inventoried in Appendix A, only 21 were drilled into bedrock because of the high yield of the overlying sediments. Beacuse of this sparsity of existing bedrock surface elevations, the seismic survey was performed. This provided detailed bedrock surface elevations for much of the study area.

The northern one-quarter of the study area is characterized by four shallow bedrock troughs which meet to form one deep north-south trending trench. The four troughs slope toward the deep trench from the general areas of the two branches of the Aberjona River to the northeast, the East Drainage Ditch to the north and the Woburn Sanitary Landfill to the northwest. The deep trench is approximately two miles long and reaches a depth of approximately 100 feet below the ground surface providing a possible trap for groundwater contamination.

The southern portion of the area is characterized by a deep trench sloping from the Stoneham/Woburn boundary to Whittemore Pond and into Winchester with depth increasing to 150 feet below the ground surface at the Woburn/Winchester boundary. A shallower trench under the Sweetwater Brook enters the deep trench approximately 1200 feet southeast of Whittemore Pond.

Between the two deep bedrock trenches in the study area is a bedrock high. All of the bedrock troughs and trenches in the study area are most likely fault-controlled. The regional geology (See Section 4.5) indicates faults trending parallel to these bedrock trenches. In general, the groundwater and surface water within the study area flow parallel to the fault shear zones and are presumably controlled by them.

4. Results of Investigation - continued

At the east and west borders of the study area, the bedrock surface rises sharply, and many bedrock outcrops are present along Route 93 and west of the Boston & Maine Railroad tracks.

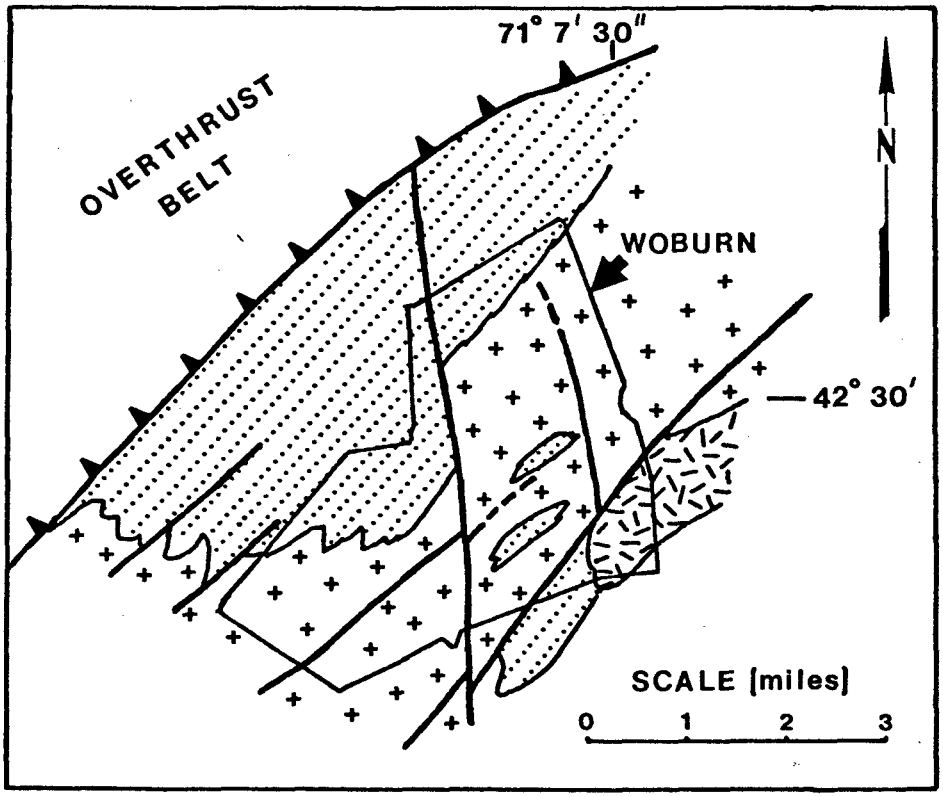
The bedrock surface contour map was used to delineate low areas where chlorinated organic solvents may have migrated downward and may be concentrated. This information, in conjunction with the water table contour map and existing analytical data was used to site the proposed monitoring wells (See Section 6). Bedrock elevations for the geologic cross-sections were taken from this map.

4.5 BEDROCK GEOLOGIC MAP, SCALE 1 inch = 2 miles (Figure 4)

A thorough search of the literature provided the data for the geologic map and accompanying description (See References 30 to 37). A glossary of terms used in the description can be found in Appendix B. A geologic time scale is presented in Appendix C.

The Woburn Study Area is situated within the Appalachian Mountain Orogenic Belt which extends from Georgia to Newfoundland. The belt is comprised of a series of plutonic, sedimentary, and volcanic rocks, Precambrian through Permian in age, most of which have undergone multiple deformation and intense metamorphism. The Northern Appalachians (New England and the Maritime Provinces) are divided by Zen (1968) into several broad linear structural features or zones. The Woburn Study Area is located in the easternmost zone called the Eastern Avalonian Platform.

The Eastern Avalonian Platform is characterized by Late Precambrian metavolcanic rocks intruded by a series of Late Precambrian granitic plutons. The age of these plutons has been radiometrically set at approximately 630 million years (Naylor,



KEY

- Salem Gabbro-diorite
- Dedham Granodiorite
- Precambrian Schists and Gneisses
- Thrust Fault
- Fault
- Contacts

FIGURE 4: GEOLOGIC MAP OF WOBURN, MASSACHUSETTS

4. Results of Investigation - continued

1975). Unconformably overlying these Precambrian rocks are fossil-bearing lower Cambrian strata composed of shales and carbonates. Superimposed on the Platform are several down-faulted blocks or basins; the Boston Basin being nearest to the Woburn area. A large thrust belt of Precambrian metavolcanic and metasedimentary rocks lies at the western edge of the platform. The Woburn Study Area (Figure 1) lies between the thrust belt and the Boston Basin. Relationships between the units described above are difficult to determine in the field because extensive glacial material overlies the bedrock resulting in widely spaced outcrops. In addition, faults have dissected the region into slices and small blocks, extensively distorting the regional geology. As a result, the geology of the study area is not well known, having been mapped in reconnaisance fashion only, by Emerson (1977), LaForge (1932), Bell and Alvord (1976), and Barosh, et. al. (1977).

The predominate rock units in the Woburn area, from youngest to oldest, are the Salem Gabbro-diorite, the Dedham Granodiorite and the Precambrian Gneisses and Schists. The Salem Gabbro-diorite, which intrudes the older Dedham Granodiorite, is a medium-grained, bluish-gray hornblende gabbro. It has been radiometrically dated at 450 $\pm$ 10 million years (Barosh, et. al., 1977)

The Dedham Granodiorite, which intrudes the Precambrian Gneisses and Schists, is a fine- to coarse-grained, pinkish-gray, locally foliated granite to quartz diorite.

The Precambrian Gneisses and Schists are presumably roof pendants and xenoliths suspended in the two units described above. Within the Woburn area, contact relationships do not indicate that these units predate the Salem Gabbro-diorite or the Dedham

4. Results of Investigation - continued

Granodiorite, but this relationship is confirmed at other localities where the Dedham Granodiorite does intrude gneisses. This group of rocks includes fine-grained, well-foliated, gray, brown, and blue colored biotite-feldspar-quartz gneisses and quartz-hornblende-feldspar gneisses; fine-grained, poorly-foliated, gray and brown quartzites; and fine- to medium-grained, dark colored, moderately schistose biotite-quartz-feldspar schists.

Where faulting occurs in any of the rocks described above, the original character of the rock is severely altered to produce a finer-grained, highly-foliated rock that is very susceptible to weathering. In time, weathering of the faulted materials will produce topographic lows or valleys within the bedrock surface. Glacial plucking is more easily accomplished in the faulted material than in the non-faulted rocks. Within the Woburn area, several faults exist, some paralleling the regional trend of the rocks (northeast-southwest) and some perpendicular to the regional trend. The bedrock lows associated with fault zones appear to control a significant amount of the groundwater and surface waters in the Woburn area.

4.6 WELL LOGS

Drillers log data for 123 wells within the study area have been acquired from several sources (References 11 to 22). This data has been interpreted and is presented in Appendix A. All known stratigraphic information for the study area is included in the well logs. The 12 geologic cross-sections presented in Section 4.7 were constructed from the well logs, bedrock surface contour map and ground surface contour map.

4. Results of Investigation - continued

4.7 GEOLOGIC CROSS-SECTIONS (Figures 6 to 17)

Vertical Scale:	1 inch = 40 feet
Horizontal Scale:	1 inch = 800 feet
Vertical Exaggeration:	20X

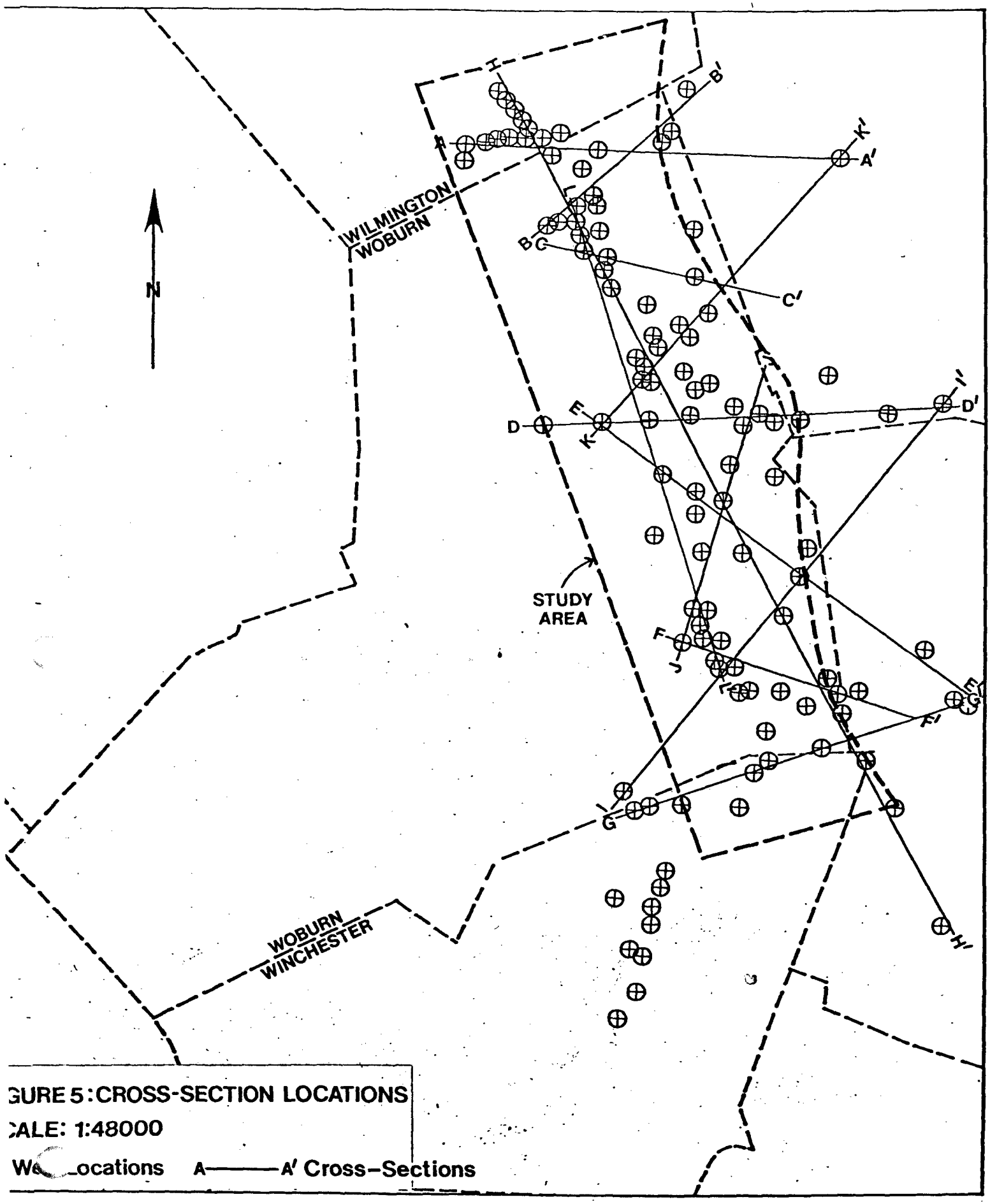
The geologic cross-sections were constructed using the well logs, the bedrock surface contour map and the ground elevation contour map. The horizontal scale of the sections is the same as that of the map sheets for comparison purposes. Ten roughly E-W sections through the study area from the Winchester/Woburn border to the Wilmington/Woburn border were prepared. In addition, two longitudinal (N-S) sections of the study area were constructed. Figure 5 is an index map of the cross-sections.

The following assumptions were made:

A. Refusal represents minimum depth to bedrock
B. Rock fragments indicate proximity to the bedrock surface
C. Units are continuous between data points
D. Contacts between units are facies changes

The dominant feature of the sections is a deep bedrock trough usually associated with the Aberjona River. This valley is filled with a variety of glacial materials ranging in size from clay to boulders. The deepest portion of the trough is usually filled with coarse sand and gravel overlain by finer sand, silt and/or clay. This indicates that the primary aquifer is in contact with bedrock. To monitor contamination in this aquifer, wells must be drilled to and into bedrock. Section 4.8 describes the surficial geology of the study area in more detail.

Longitudinal section H - H' shows a bedrock trough filled with glacial material associated with the Sweetwater Brook which enters Woburn from Stoneham. This trough is a potential conduit for groundwater contaminants as it is overlain by a surface water stream which is contaminated with parts per million levels of trichloroethylene, 1,1,1-trichloroethane and an unidentified volatile organic (Reference 3). Contamination has very likely migrated into the permeable sediments filling the trough.



GURE 5: CROSS-SECTION LOCATIONS

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W[illegible]ocations A———A' Cross-Sections

4. Results of Investigation - continued

4.8 SURFICIAL GEOLOGY

The following discussion of the surficial geology of the study area is based upon the existing literature (References 36 & 37) and the geologic cross-sections presented in Section 4.7.

The surficial geology of the Woburn Study Area is primarily controlled by glacial deposits. The surface deposits consist of a complex mixture of glacial clays, sands, gravel, and tills, and recent floodplain deposits of the Aberjona River System. The majority of the sediments are the result of Late Wisconsin glaciation which retreated through the Mystic River and Aberjona River Valleys 14,000 years ago (Kaye, 1976 and Chute, 1959).

As discussed in Section 4.5, the surficial deposits are controlled to some extent by the bedrock topography, the most prominent feature of which is a fault-controlled valley. This valley was probably widened and deepened during Pleistocene glaciation. Locally, the valley has very steep walls, but throughout most of the study area, it has gently sloping walls.

The areas adjacent to the valley are mantled with glacial till consisting of poorly sorted sands, silts, clays, and cobbles. The bedrock valley contains glacial deposits up to 160 feet thick overlain by modern alluvial deposits. The glacial material in the valley consists of outwash deposits of fine-to coarse-grained sands and gravel interbedded with fine sand, silt, clay and till. Well log data indicate that the sediments generally become coarser with depth. Upper and central portions of the valley contain finer sands, silts, and clays, while the coarser sands, gravels, and till are located at the bottom and along the walls of the valley. Much of the finer materials was deposited by meltwater streams which sorted and reworked the valley material.

4. Results of Investigation - continued

Modern alluvium associated with the Aberjona River System consists of peat deposits and bogs located along the current course of the river and its tributaries. Topsoil and artificial fill make up the top five to ten feet of the surface deposits except in North Woburn where extensive reworking of the sediments by man has severely disrupted the surficial deposits.

4.9 DATA SUPPLEMENT

A data supplement containing time-distance data generated during the seismic survey and specifications for well installations has been prepared by E & E and will be made available as required. Sampling protocols and analytical procedures are presented in detail in the groundwater quality report (TDD F1-8010-04B) for East and North Woburn.

SECTION 5 - SITE SELECTION OF MONITORING WELLS

In order to delineate the extent of groundwater contamination within the study area, twenty monitoring wells have been sited and the proposed locations marked on the Base Map (Sheet 1). The proposed locations are based on all data presented in Section 4 of this report. Each well should be drilled to bedrock to monitor chlorinated organics which commonly migrate downward to the base of an aquifer. A ten-foot core of the bedrock should be retrieved at each well to determine the competency of the bedrock and the possibility of contaminants migrating into the bedrock. A split-spoon sampler should be used to retrieve a continuous record of the stratigraphy in the area. Permeabilities can be determined from appropriate sections of the column.

Below is a list of the proposed well locations and the rationale for each:

1. Just north of the Tabby Cat Food Pond to monitor contamination entering Woburn from Wilmington to the north.

2. Gravel pit at the intersection of the Woburn/Wilmington and Woburn/Reading boundaries to monitor contamination entering Woburn from Reading to the northeast.

3. South of the Woburn Sanitary Landfill to monitor contamination entering the groundwater from the landfill.

4. Behind American Discount Auto Parts (ADAP) near the intersection of Route 128 and the B & M Railroad tracks to monitor contamination entering East Woburn from North Woburn. For the purpose of this report, Route 128 is designated as the boundary between North and East Woburn.

5. Behind Charrette Corporation on Olympia Avenue to monitor contamination entering East Woburn from North Woburn.

6. At the intersection of Route 128 and Commerce Way to monitor contamination entering East Woburn from North Woburn.

7. At the intersection of Routes 128 and 93 to monitor contamination entering Woburn from the southwest corner of Reading.

5. Site Selection of Monitoring Wells - continued

8. Midway between Woburn Wells "G" and "H" to determine extent of contamination near the municipal wells.

9. At the south end of Walnut Hill Road. This well and the three following will be used to monitor contamination migrating southward from the vicinity of municipal wells "G" and "H".

10. On Montvale Road just east of Pine Street.

11. Just west of the Aberjona River and east of Montvale Road.

12. Just east of the Aberjona River near Well 422

13. At the headwaters of the Sweetwater Brook to monitor contamination entering East Woburn from Stoneham.

14. At the intersection of Route 93 and Montvale Avenue to monitor contamination entering East Woburn from Stoneham in the vicinity of the Sweetwater Brook.

15. Just northwest of the intersection between Route 93 and Montvale Avenue to monitor contaminants which entered the groundwater as a result of activities at Tanners Degreasing.

16. Just east of the Aberjona River on Atlantic Gelatin property to monitor contamination entering Woburn from Stoneham by way of the Sweetwater Brook or associated bedrock trough.

17. At the southwest corner of the Calvary Cemetary to monitor contamination entering Winchester from Woburn.

18. At the intersection of the Aberjona River and Garfield Avenue in Winchester to monitor contamination moving southward from Woburn.

19. West of Halls Brook Storage Area on New Boston Road to monitor contamination which entered the groundwater as a result of past activities at the former site of Roketenetz Piggery.

20. Just south of Whittemore Pond to monitor contaminants present in the deep bedrock trench in that area.

Listed in Table 2 are the parameters for each of the proposed monitoring wells calculated from the ground elevation, water table and bedrock surface contour maps.

TABLE 1

Parameters for the Proposed Monitoring Wells in North and East Woburn, Massachusetts

Well #	Altitude of Ground Surface (ft MSL)	Static Water Level (ft MSL)	Bedrock Surface Altitude (ft MSL)	Saturated Thickness (ft)	Well Depth* (ft)
1	82	67	40	27	52
2	100	65	50	15	60
3	80	70	35	35	55
4	55	50	-20	70	85
5	56	45	-25	70	91
6	70	50	20	30	60
7	109	95	60	35	59
8	45	44	-45	89	100
9	55	44	0	44	65
10	81	40	-20	60	111
11	45	40	-10	50	65
12	45	43	10	33	45
13	100	95	90	5	20
14	50	38	18	17	42
15	45	29	0	29	55
16	35	22	-20	42	65
17	45	24	-25	49	80
18	34	18	-60	78	104
19	70	60	20	40	60
20	50	40	-80	120	140

* Including 10 feet in bedrock

SECTION 6 - REFERENCES

1. Cook, D. K. Site Inspection Reports for E. C. Whitney and Sons, Whitney Barrel Company, Ritter Trucking Company, Raffi & Swanson, Inc., MDC Septage Receiving Station, New England Resins and Pigments, Woburn Steel Drum, Inc., and Woburn Sanitary Landfill. EPA FIT Project. TDD F1-8006-01. (28 August -17 September 1980)

2. Cook, D. K. Site Inspection Report for Olin Chemicals Group Wilmington Plant. EPA FIT Project. TDD #F1-8005-01F. 48 pp. (5 December 1980)

3. Cook, D. K. Site Inspection Reports for Severence Trucking Company, Inc., Aberjona Auto Parts, John J. Riley Company, Whitney Barrel Company, Atlantic Gelatin and Independent Tallow Company. EPA FIT Project. TDD #F1-8005-01E. 20 November -17 December 1980)

4. Priority Pollutant Samples (Table 1, Samples 1-10), Collected by E & E - 23 January 1981 to 30 January 1981, Analyzed by Acurex on 26 February 1981

5. Priority Pollutant Samples (Table 1, Samples 11-15), Collected by E & E - 12 November 1980 to 2 December 1980, Analyzed by ERCO on 23 December 1980

6. Priority Pollutant Samples (Table 1, Samples 16 & 17) Collected by Arthur White 16 September 1980, Analyzed by ERCO on 2 October 1980

7. Priority Pollutant Samples (Table 1, Samples 18, 19 and 22) Collected by EPA/Lexington - 23 July 1979?, Analyzed by EPA/Lexington on 24 July 1979.

8. Priority Pollutant Samples (Table 1, Analyses 20 and 23), Collected by Massachusetts DEQE - 24 September 1979, Analyzed by Lawrence Experiment Station on 25 and 26 September 1979.

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APPENDIX A

WELL LOGS